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The Resources Agency  
DEPARTMENT OF WATER RESOURCES  
Northern District

FISHERIES MONITORING  
INDIAN CREEK, PLUMAS COUNTY

2005

Technical Information Report ND-06-01

Prepared by

Aric Lester, Environmental Scientist

Under the Supervision of

Fraser Sime, Senior Environmental Scientist

This report was prepared to summarize information collected under SAP Internal Order 100493 to document recreation and fishery enhancement provided by a revised operation of Antelope Reservoir. This report received only limited review; it is intended for internal use and should be considered preliminary and subject to revision.

August 2006

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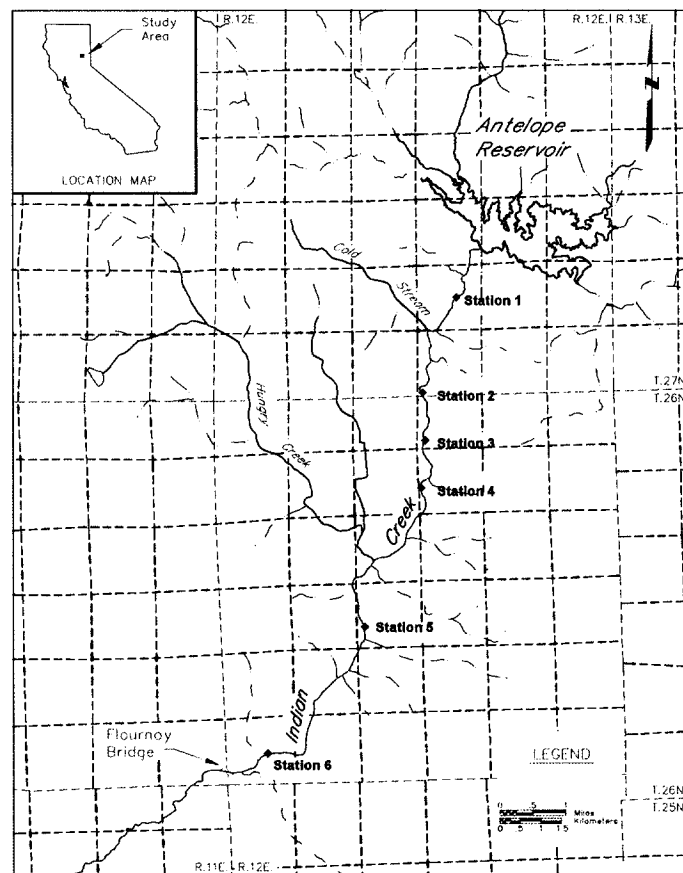
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## Description of Study Area

The Indian Creek study area consists of a 21 kilometer (13 mile) reach that extends from the base of Antelope Dam to Flournoy Bridge (Figure 1). The first mile of Indian Creek below Antelope Dam is a meandering gravel bedded stream. Below this, the stream is mostly confined as it flows through a canyon where cobbles and large boulders become the predominant substrate. Beavers have been actively constructing dams throughout much of the study area in recent years and ponds have become common. Below the study area the creek flows through meadow and pasture for about 27 kilometers (17 miles) before descending into the North Fork Feather River. Elevation in the study area averages 1464 m (4803 ft) and the vegetative type is predominately mixed conifer forest with the riparian zone mostly characterized by an alder overstory with a bunch grass understory.

Figure 1. Map of the Indian Creek study area and the sample stations.



Stream flow is a combination of releases from Antelope Dam and inflow from tributaries such as Cold Stream and Hungry Creek. Storms and snowmelt can raise flows to flood levels in February through May. Significant flooding occurred in 1982, 1983, 1986, and 1995. Summer flow is largely comprised of releases from the dam. Releases from the

dam are 0.14 cms (5 cfs) in very dry years, 0.28 cms (10 cfs) in dry years, and 0.6 cms (20 cfs) in normal or wet years. Prior to the dam, average summer flow was 0.08 cms (3 cfs) at the dam site (Hinton and Haines 1981).

Macroinvertebrates in the study area include mayflies of the genus *Baetis*, stoneflies of the genus *Hydropsyche*, flies of the subfamily *Chironomidae*, and flies of the genus *Simulium* (Boles 1980). Fishes occurring in Indian Creek include: rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), golden shiners (*Notemigonus crysoleucas*), Sacramento pikeminnow (*Ptychocheilus grandus*), hardhead (*Mylopharodon conocephalus*), Lahontan redbreast (*Richardsonius egregius*), speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), brown bullhead (*Amiurus nebulosus*) and various sunfish (*Lepomis* spp.). Black bass (*Micropterus* spp.) and channel catfish (*Ictalurus punctatus*) have also been observed.

## Methods

### Physical Measurements

Standing stocks of fishes were estimated at six stations in Indian Creek (Figure 1). Stations were at or near those sampled in previous DFG studies (Gerstung 1973; Brown 2001) to allow comparisons to historical data. The stations were delineated to include a mix of riffle, run, and pool habitats to the extent possible. The length of each stream habitat type within the station (riffle, pool, run) was measured with a metric tape. Station length and six evenly distributed width measurements were also taken. Station length ranged from 48 to 59.5 meters (Table 1). To relocate the stations in the future, GPS coordinates were taken at each of the downstream net sites. At each station, field measurements of electro conductivity, salinity, and total dissolved solids were measured using an ExStick EC400 Meter by EXTECH. Water temperature was measured at the final station with a mercury thermometer. This information about the stations is available in Appendix A.

Table 1. Physical measurements for the stations within the Indian Creek study area.

Station	Distance Below Dam (km)	Average Width (m)	Length (m)	Area (m <sup>2</sup> )	%Habitat Type @ 0.15 cms		
					Riffle	Pool	Run
1	1.8	5.7	53.3	301.6	81.4	18.6	0
2	4.7	6.3	50.5	319.0	58	30	12
3	6	5.7	48	275.2	8.3	32.2	59.5
4	7.6	4.8	50.5	390.2	4	0	96
5	11.9	7.1	50.5	356.9	11.3	15.5	73.2
6	16.9	5.7	59.5	337.2	31.1	11.9	57

### Biological Measurements and Analysis

Each station was sampled for fish using a single battery-powered backpack electrofisher (Smith-Root models LR 24 or 12B). The upstream and downstream ends

of the station were blocked using seines as described by Platts et al. (1983). Just before the sample period, releases from the dam were reduced to 0.15 cms (5 cfs) so the channel can be effectively blocked off with the nets and to improve visibility and collection efficiency. This is commensurate with what has been done in previous years. Two netters captured fish and passed them to a person with a bucket as they followed the operator upstream. The electrofisher was set to deliver enough power to effectively capture fish while minimizing the period it took fish to recover (USFWS 2000). The settings can be found in Appendix A.

For each fish caught, species, fork length to the nearest millimeter, and volumetric displacement to the nearest milliliter were taken. Fish density was assumed to be equal to water density (1 ml water = 1 g). Fish were then immediately released outside of the enclosed section. Successive removals were made until substantial depletion in the number of fish captured was observed.

Population estimates for rainbow trout and brown trout at each of the sample stations were processed using MicroFish 3.0 (Van Deventer and Platts 1989). Biomass for each station was calculated as the estimated total weight of the population (Population Estimate/Catch X Total Weight of Catch) for the station divided by the station's surface area. Also for each station, the number of catchable trout (trout  $\geq 127$  mm) in the population was estimated (Catchable/Total Catch X Population Estimate) and Fulton Condition factors ( $K = (W/L^3) \times 100,000$ ) were calculated for each fish. Population parameter estimates for the entire study area represent the mean for the six sample stations.

The average population size, biomass, number of catchable trout, and condition factor were also calculated for fifteen years of historical data collected within the study area between 1977 and 2002 (DFG 2005) and compared to the data collected in 2005 to assess the relative status of the 2005 population. The population parameters were compared using a one-tailed *t* test at the 95% confidence level to determine if differences were statistically significant. This represents a basic analysis of the data to assess the status of the population. A more complex analysis and rigorous testing of the data could be conducted that considers the other sources of variability beyond the annual variability that is considered here, but such a study is beyond the scope of this report. Also, with electrofishing data there is a large amount of sample error; this analysis assumes sample error is somewhat consistent between years and does not consider it beyond this assumption.

## **Results**

### **Distribution**

Brown trout were captured at all six stations and were most abundant at Station 1. Rainbow trout were captured at all stations except Station 3 and in contrast to brown

trout were most common at the lowest station, Station 6. Sacramento sucker, Sacramento pikeminnow, and green sunfish were only captured at Station 6 (Table 2).

The distribution of rainbow trout within the study area is similar to what has occurred historically, while the distribution of brown trout differed from the majority of historical sample efforts (Figure 2). Generally, more rainbow trout occur in the downstream portion of the study area in the last two stations. Rainbow trout abundance in the middle and upper two stations is historically low or highly variable. Of note, 2005 represents the first year rainbow trout have been captured in Station 1 since 1988. As for brown trout in 2005, most were in the upper two stations, where historically most sample efforts captured the majority of brown trout in the middle three stations. Relative abundance for brown trout at Station 1 was very high compared to the historical mean. Table 3 depicts the catch and estimate for population, trout per 100 meters, and biomass for each station in 2005.

Table 2. Fish species captured at stations sampled on Indian Creek, Plumas County, 2005.

Species							
Common Name	Scientific Name	1	2	3	4	5	6
Brown Trout	<i>Salmo trutta</i>	x	x	x	x	x	x
Rainbow Trout	<i>Oncorhynchus mykiss</i>	x	x		x	x	x
Sacramento Pikeminnow	<i>Ptychocheilus grandis</i>						x
Sacramento Sucker	<i>Catostomus occidentalis</i>						x
Green Sunfish	<i>Lepomis cyanellus</i>						x

Figure 2. 2005 Rainbow trout and brown trout distribution among the sample stations shown as relative abundance (trout/hectare) for each station as a percentage of the total population estimate. The historical mean and standard error are shown.

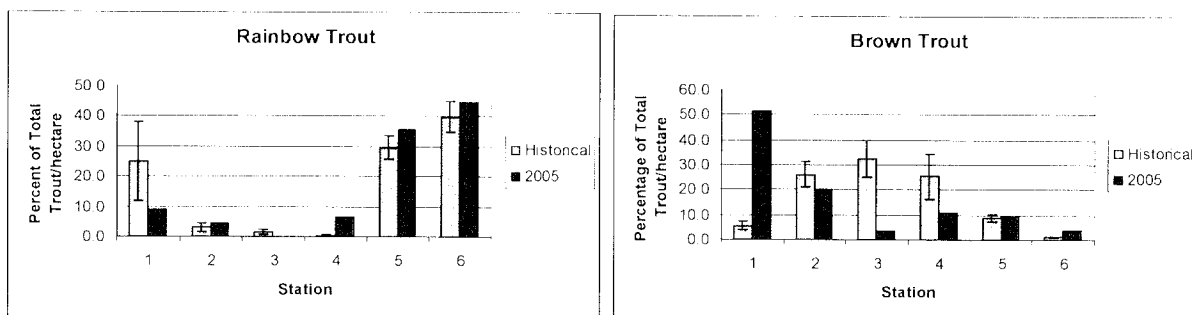


Table 3. Rainbow trout and brown trout catch and estimates for population, trout per 100 meters, and biomass for each Indian Creek station in 2005.

Station	Station Length	Catch	Population Estimate	Population Est. 95% Confidence		Trout/100m	Biomass g/m2
				Lower Limit	Upper Limit		
Rainbow Trout							
1	53.3	2	2	2	14.7	3.8	0.22
2	50.5	1	1	0 trout 2nd pass		2	0.1
3	48	0	0	0	0	0	0
4	81	2	2	0 trout 2nd pass		2.5	0.13
5	60	9	11	9	21.95	18	0.66
6	59.5	11	11	11	11.73	19	1.3
Brown Trout							
1	53.3	79	135	79	225	253	7.8
2	50.5	52	56	52	64	111	7.1
3	48	8	8	8	10	17	1.1
4	81	38	40	38	45	49	7.6
5	60	33	35	33	41	58	3.3
6	59.5	11	12	11	18	20	0.59

## Population Parameter Estimates and Comparison to Historical Data

### Rainbow Trout

In 2005, the population estimate for rainbow trout was 12 trout/hectare (about 7 trout/100 m of stream). The historical mean was greater at 16 trout/hectare (about 11 trout/100 m of stream), but was not significantly greater than the 2005 estimate when compared using a one-tailed *t* test (Table 4). The 2005 biomass estimate for rainbow trout was 0.38 g/m<sup>2</sup>. The historical mean biomass was 0.62 g/m<sup>2</sup>, and was significantly greater than the 2005 estimate. The mean condition factor for rainbow trout in 2005 was 1.19. The historical mean was 1.10, and was significantly less than the 2005 mean condition factor. The estimated number of catchable rainbow trout in the study reach was 0.0072 trout/hectare in 2005. The historical mean was 0.008 trout/hectare, but was not significantly greater than the 2005 estimate. These data for each of the population parameters are depicted in Figure 3.

Table 4. Rainbow trout test statistics for comparison of historical means to 2005 estimates using a one-tailed *t* test for trout/hectare, biomass, condition factor, and catchable trout/hectare.

Year	Population Estimate (trout/hectare)	Biomass (g/m <sup>2</sup> )	Condition Factor	Catchable Trout (trout/hectare)
1977	4.9	0.26	1.19	0.0043
1978	14	0.36	1.18	0.0054
1979	13	1.0	1.02	0.0080
1980	37	1.2	1.05	0.014
1981	15	0.058	1.05	0.012
1982	33	0.75	1.10	0.012
1986	30	0.85	1.16	0.011
1987	14	1.7	1.10	0.012
1988	8.5	0.27	1.16	0.0044
1990	11	0.87	0.97	0.0087
1993	6.2	0.43	1.13	0.0062
1995	14	0.39	1.09	0.0088
1999	19	0.75	1.05	0.0095
2001	8.4	0.19	1.14	0.0029
2002	12	0.19	1.14	0.0038
<b>Hist Mean</b>	<b>16</b>	<b>0.62</b>	<b>1.10</b>	<b>0.008</b>
<b>2005 Est.</b>	<b>12</b>	<b>0.38</b>	<b>1.19</b>	<b>0.0072</b>
s <sup>2</sup>	96.16	0.21	0.0040	0.000012
s <sub>x</sub>	2.532	0.119	0.016	0.001
t	<b>1.627</b>	<b>2.046</b>	<b>-5.361</b>	<b>1.071</b>
t <sub>0.05(1),14</sub>	<b>1.761</b>	<b>1.761</b>	<b>1.761</b>	<b>1.761</b>
p	>.05	>.025 <.05	<.0005	>.05
H <sub>0</sub>	Accept	Reject	Reject	Accept
Conclusion	Average	Below Average	Above Average	Average

Figure 3. Rainbow trout population (trout/hectare), biomass (g/m<sup>2</sup>), condition factor, and catchable trout (trout/hectare) for each year the Indian Creek study area was sampled. The mean and standard error for each year are shown along with the historical mean (dashed line).

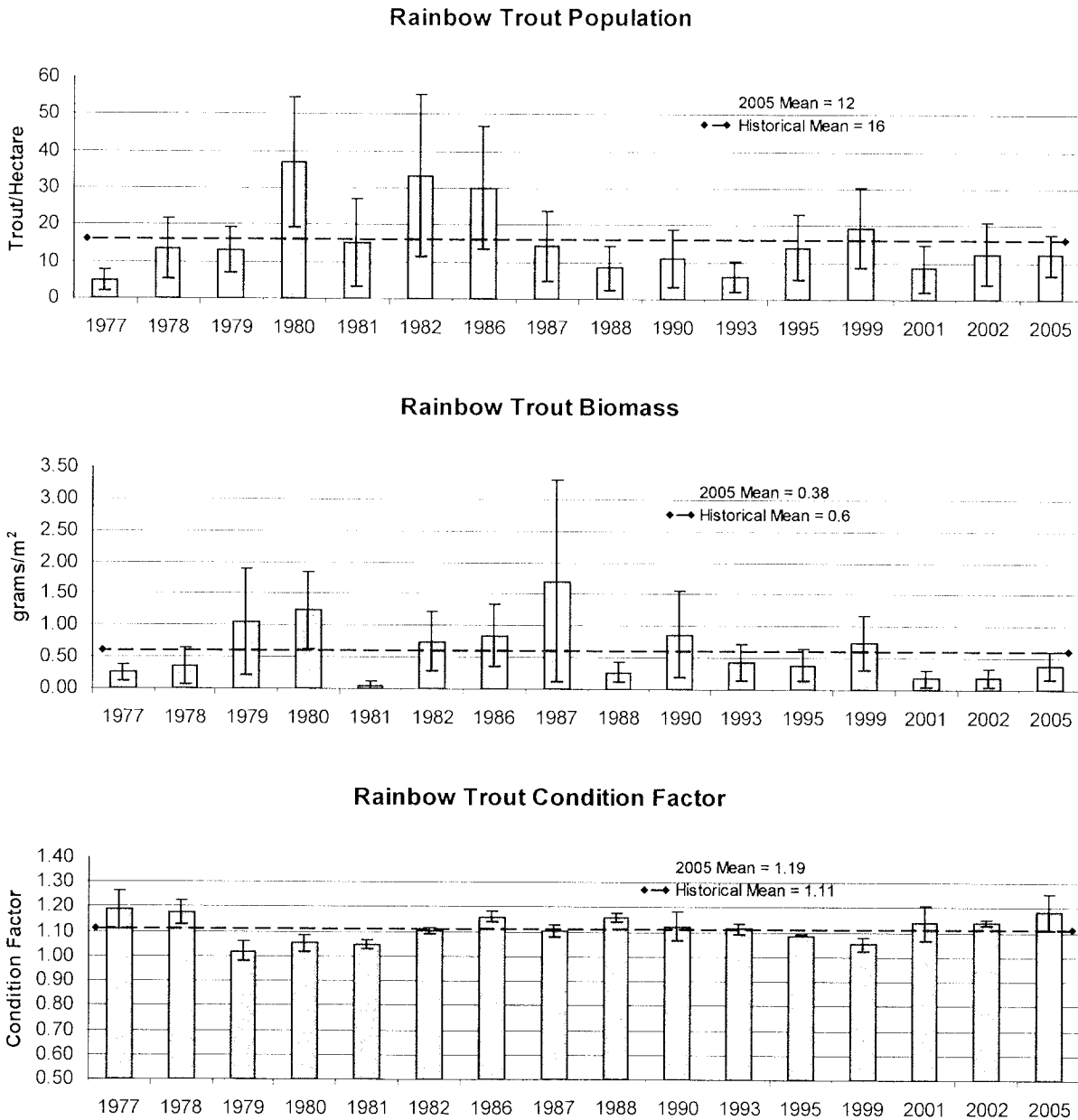
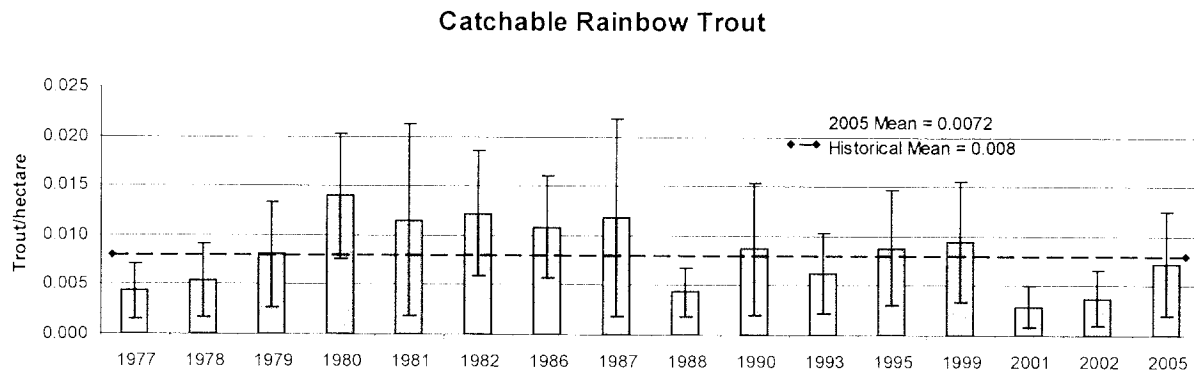


Figure 3.



### Brown Trout

In 2005, the population estimate for brown trout was 144 trout/hectare (about 86 trout/100 m of stream). The historical mean was 151 trout/hectare (about 106 trout/100 m of stream), but was not significantly greater than the 2005 population (Table 5). The biomass estimate for brown trout was 4.6 g/m<sup>2</sup>. The historical mean was 3.9 g/m<sup>2</sup>, significantly less than the 2005 biomass estimate. The mean condition factor for brown trout was 1.11. The historical mean condition factor was 1.10, but was not significantly less than the 2005 mean condition factor. The estimated number of catchable brown trout in the study reach was 0.051 trout/hectare in 2005. The historical mean was 0.047, not significantly less than the 2005 estimate.

Table 5. Brown trout test statistics for comparison of historical means to 2005 estimates using a one-tailed *t* test for trout/hectare, biomass, condition factor, and catchable trout/hectare.

Year	Population Estimate (trout/hectare)	Biomass (g/m <sup>2</sup> )	Condition Factor	Catchable Trout (trout/hectare)
1977	138	4.9	1.15	0.071
1978	78	3.9	1.15	0.030
1979	369	3.7	1.07	0.024
1980	146	5.1	1.05	0.11
1981	204	4.2	1.08	0.051
1982	95	4.4	1.11	0.084
1986	27	2.4	1.17	0.026
1987	139	3.3	1.11	0.011
1988	486	4.2	1.08	0.047
1990	173	4.0	1.12	0.034
1993	65	4.5	1.09	0.057
1995	62	4.1	1.08	0.053
1999	69	2.5	1.07	0.036
2001	89	3.3	1.04	0.028
2002	121	3.4	1.12	0.044
<b>Hist Mean</b>	<b>151</b>	<b>3.86</b>	<b>1.10</b>	<b>0.047</b>
<b>2005 Est.</b>	<b>144</b>	<b>4.6</b>	<b>1.11</b>	<b>0.051</b>
s <sup>2</sup>	15308.49	0.60	0.0015	0.00066
s <sub>x</sub>	31.946	0.199	0.010	0.007
t	<b>0.210</b>	<b>-3.690</b>	<b>-1.125</b>	<b>0.587</b>
t <sub>0.05(1),14</sub>	<b>1.761</b>	<b>1.761</b>	<b>1.761</b>	<b>1.761</b>
p	>.05	>.001 <.05	>.05	>.05
H <sub>0</sub>	Accept	Reject	Accept	Accept
Conclusion	Average	Above Average	Average	Average

Figure 4. Brown trout mean population (trout/hectare), biomass (g/m<sup>2</sup>), condition factor, and catchable trout (trout/hectare) for each year the Indian Creek study area was sampled. The mean and standard error for each year are shown along with the historical mean (dashed line).

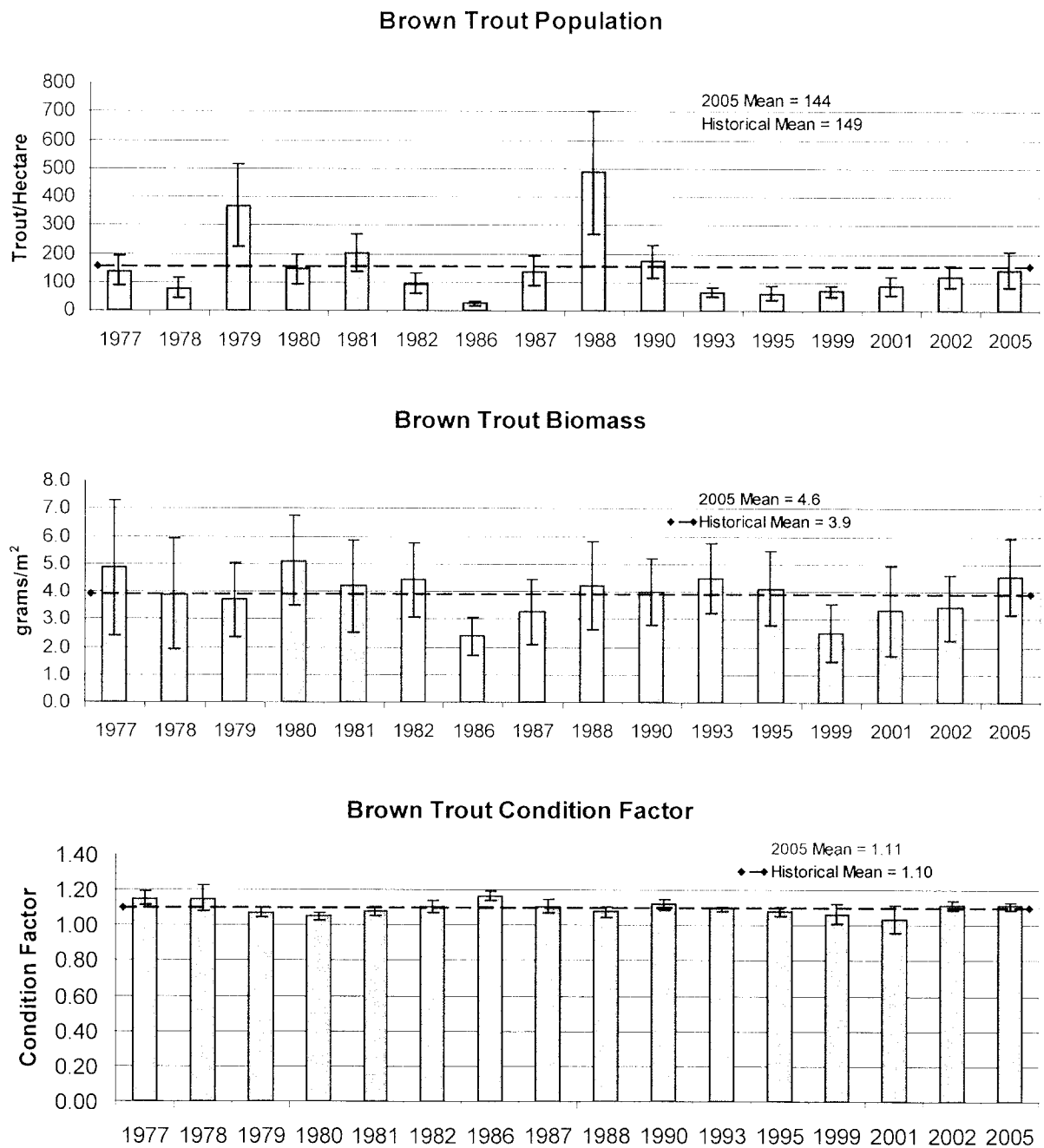
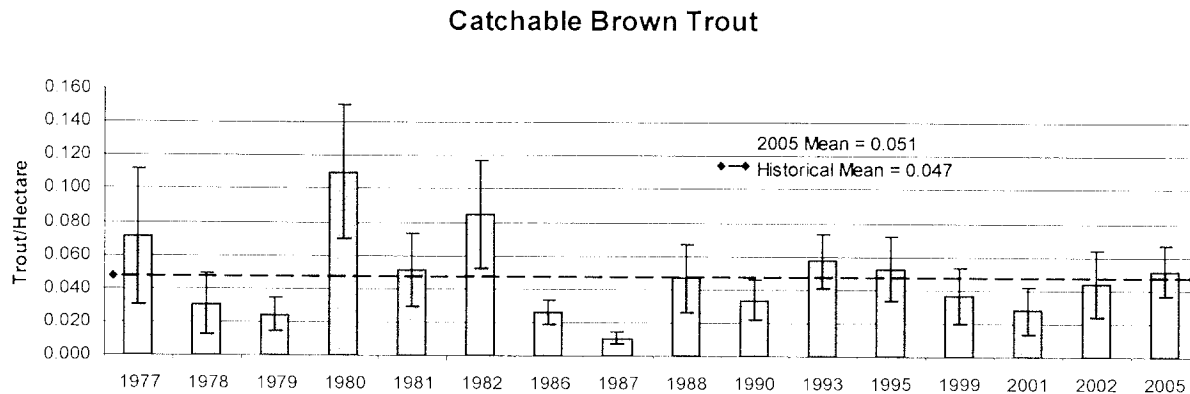


Figure 4.



Within the Indian Creek study area, the sample data indicates that the rainbow trout and brown trout populations in 2005 were typical for the study area and in moderate or good condition when compared to the historical data. The distribution of brown trout in the study area was outside the norm, however. The distribution of rainbow trout did not differ greatly from what was observed historically.

In summary, the 2005 rainbow trout population estimate was not statistically below the historical average for 2005 although the fish that made up the population were below average in size when compared to historical data. However, the estimated abundance of trout greater than or equal to 127mm (catchable rainbow trout) in the population was not statistically below the average. Rainbow trout condition in 2005 was above average when compared to the historical mean.

The brown trout population estimate was not statistically below the historical average for 2005. In contrast to rainbow trout, the fish that made up the population were above average in size when compared to historical data. The abundance of catchable brown trout was not significantly above the historical mean, however. Brown trout condition was not significantly different than the historical mean in 2005.

In regard to distribution, most brown trout were in the upper two stations, while historically most sample efforts observed the majority of brown trout in the middle three stations. Of note, 2005 represents the first year rainbow trout have been captured in Station 1 since 1988. The higher abundance of trout in the upper stations could be attributable to the cool wet spring conditions that occurred in 2005.

As mentioned above, this represents a basic analysis of the data to assess the status of the population. A more complex analysis and rigorous testing of the data could be conducted that considers the other sources of variability beyond the annual variability that is considered here. The age structure or length frequency of the population could also be examined to assess recruitment.

## **Acknowledgements**

Thanks go to David Grant, Audrey Silbernagel, and Mara Kraemer of the Department of Fish and Game and Ralph Hinton of the Department of Water Resources for their help with electrofishing and consolidation of the historical data. Thanks also go to Margie Graham, Doug Rischbieter, and Ralph for reviewing early drafts and providing insightful comments and suggestions.

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## Appendix A

### Fish captured in 2005 electrofishing effort

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer

Date 9/27/05

Time Begin 11:45 End Time: 12:10

Creek: Indian Creek

Station: 1

Reach Length: 53.3 m

GPS UTM, 10, NAD 83 - DS Net:

4449269 N 703092 E

Weather: Mostly clear; mid 70's by afternoon

Pass	Scientific Name	Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1	<i>Salmo trutta</i>	Brown Trout	63	1	3.0	
	<i>Salmo trutta</i>	Brown Trout	68	1	3.0	
	<i>Salmo trutta</i>	Brown Trout	69	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	69	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	72	1	5.0	
	<i>Salmo trutta</i>	Brown Trout	73	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	73	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	74	1	5.0	
	<i>Salmo trutta</i>	Brown Trout	74	1	5.0	
	<i>Salmo trutta</i>	Brown Trout	75	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	75	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	77	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	78	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	79	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	80	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	83	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	83	1	7.0	
	<i>Salmo trutta</i>	Brown Trout	83	1	7.0	
	<i>Salmo trutta</i>	Brown Trout	84	1	7.0	
	<i>Salmo trutta</i>	Brown Trout	85	1	7.0	
	<i>Salmo trutta</i>	Brown Trout	85	1	8.0	
	<i>Salmo trutta</i>	Brown Trout	85	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	86	1	8.0	
	<i>Salmo trutta</i>	Brown Trout	87	1	8.0	
	<i>Salmo trutta</i>	Brown Trout	88	1	9.0	
	<i>Salmo trutta</i>	Brown Trout	92	1	9.0	
	<i>Salmo trutta</i>	Brown Trout	94	1	9.0	
	<i>Salmo trutta</i>	Brown Trout	94	1	16.0	
	<i>Salmo trutta</i>	Brown Trout	94	1	10.0	
	<i>Salmo trutta</i>	Brown Trout	95	1	10.0	
	<i>Salmo trutta</i>	Brown Trout	96	1	11.0	
	<i>Salmo trutta</i>	Brown Trout	99	1	10.0	
	<i>Salmo trutta</i>	Brown Trout	101	1	13.0	
	<i>Salmo trutta</i>	Brown Trout	105	1	15.0	
	<i>Salmo trutta</i>	Brown Trout	107	1	15.0	
	<i>Salmo trutta</i>	Brown Trout	108	1	13.0	
	<i>Salmo trutta</i>	Brown Trout	110	1	14.0	
	<i>Salmo trutta</i>	Brown Trout	110	1	16.0	
	<i>Salmo trutta</i>	Brown Trout	112	1	13.0	
	<i>Salmo trutta</i>	Brown Trout	112	1	16.0	
	<i>Salmo trutta</i>	Brown Trout	114	1	18.0	
	<i>Salmo trutta</i>	Brown Trout	118	1	20.0	
	<i>Salmo trutta</i>	Brown Trout	215	1	125.0	
	<i>Salmo trutta</i>	Brown Trout	226	1	140.0	
	<i>Salmo trutta</i>	Brown Trout	242	1	180.0	
	<i>Salmo trutta</i>	Brown Trout	278	1	260.0	
	<i>Salmo trutta</i>	Brown Trout	299	1	340.0	
				<b>47</b>	<b>1417.0</b>	

# Station 1 Continued

	<i>Oncorhynchus mykiss</i>	Rainbow Trout	67	1	4.0	
				1	4.0	
2	<i>Salmo trutta</i>	Brown Trout	50	1	1.0	Dead
	<i>Salmo trutta</i>	Brown Trout	56	1	2.0	
	<i>Salmo trutta</i>	Brown Trout	65	1	3.5	Dead
	<i>Salmo trutta</i>	Brown Trout	69	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	71	1	5.0	
	<i>Salmo trutta</i>	Brown Trout	72	1	4.0	
	<i>Salmo trutta</i>	Brown Trout	72	1	4.5	
	<i>Salmo trutta</i>	Brown Trout	76	1	4.5	
	<i>Salmo trutta</i>	Brown Trout	77	1	6	
	<i>Salmo trutta</i>	Brown Trout	80	1	5.0	
	<i>Salmo trutta</i>	Brown Trout	80	1	6	
	<i>Salmo trutta</i>	Brown Trout	81	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	81	1	5.5	
	<i>Salmo trutta</i>	Brown Trout	81	1	6	
	<i>Salmo trutta</i>	Brown Trout	82	1	6.0	
	<i>Salmo trutta</i>	Brown Trout	94	1	9.0	
	<i>Salmo trutta</i>	Brown Trout	95	1	10.5	
	<i>Salmo trutta</i>	Brown Trout	98	1	10.0	
	<i>Salmo trutta</i>	Brown Trout	99	1	12.0	
	<i>Salmo trutta</i>	Brown Trout	100	1	8.5	
	<i>Salmo trutta</i>	Brown Trout	105	1	14.0	
	<i>Salmo trutta</i>	Brown Trout	108	1	15.0	
	<i>Salmo trutta</i>	Brown Trout	110	1	15.0	
	<i>Salmo trutta</i>	Brown Trout	111	1	17.0	
	<i>Salmo trutta</i>	Brown Trout	115	1	17.0	
	<i>Salmo trutta</i>	Brown Trout	186	1	83.0	
	<i>Salmo trutta</i>	Brown Trout	190	1	89.0	
	<i>Salmo trutta</i>	Brown Trout	195	1	90.0	
	<i>Salmo trutta</i>	Brown Trout	202	1	105.0	
	<i>Salmo trutta</i>	Brown Trout	205	1	105.0	
	<i>Salmo trutta</i>	Brown Trout	210	1	135.0	
	<i>Salmo trutta</i>	Brown Trout	215	1	120.0	
				32	924.0	
	<i>Oncorhynchus mykiss</i>	Rainbow Trout	56	1	2.5	Dead
				1	2.5	

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer

Date 9/28/05

Time Begin 11:20 End Time: 12:00

Creek: Indian Creek

Station: 2

Reach Length: 50.5 m

GPS UTM, 10, NAD 83 - DS Net:

4446993 N 702261 E

Weather: Mostly clear; mid 70's by afternoon

Pass		Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1		Brown Trout	75	1	5.0	
		Brown Trout	80	1	6.0	
		Brown Trout	81	1	7.0	
		Brown Trout	83	1	6.0	
		Brown Trout	85	1	8.0	
		Brown Trout	90	1	8.0	
		Brown Trout	93	1	10.0	
		Brown Trout	94	1	9.0	
		Brown Trout	95	1	9.0	
		Brown Trout	133	1	30.0	
		Brown Trout	136	1	28.0	
		Brown Trout	150	1	44.0	
		Brown Trout	150	1	36.0	
		Brown Trout	154	1	38.0	
		Brown Trout	158	1	48.0	
		Brown Trout	160	1	54.0	
		Brown Trout	161	1	48.0	
		Brown Trout	163	1	46.0	
		Brown Trout	168	1	58.0	
		Brown Trout	168	1	52.0	
		Brown Trout	177	1	58.0	
		Brown Trout	179	1	60.0	
		Brown Trout	198	1	92.0	
		Brown Trout	202	1	90.0	
		Brown Trout	210	1	104.0	
		Brown Trout	210	1	100.0	
		Brown Trout	220	1	120.0	
		Brown Trout	230	1	130.0	
				<b>28</b>	<b>1304.0</b>	
		Rainbow Trout	133	1	32.0	
				<b>1</b>	<b>32.0</b>	
2		Brown Trout	295	1	300.0	
		Brown Trout	165	1	50.0	
		Brown Trout	193	1	70.0	
		Brown Trout	171	1	56.0	
		Brown Trout	164	1	54.0	
		Brown Trout	158	1	50.0	
		Brown Trout	150	1	38.0	
		Brown Trout	167	1	52.0	
		Brown Trout	143	1	34.0	
		Brown Trout	155	1	48.0	
		Brown Trout	87	1	7.0	
		Brown Trout	91	1	9.0	
		Brown Trout	90	1	8.0	
		Brown Trout	91	1	10.0	
		Brown Trout	89	1	7.0	
		Brown Trout	74	1	4.0	
		Brown Trout	75	1	5.0	
		Brown Trout	78	1	6.0	

## Station 2 Continued

		Brown Trout	70	1	4.0	
		Brown Trout	70	1	4.0	
				<b>20</b>	<b>816.0</b>	
3		Brown Trout	175	1	64.0	
		Brown Trout	172	1	52.0	
		Brown Trout	90	1	9.0	
		Brown Trout	90	1	9.0	
				<b>4</b>	<b>134.0</b>	

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer

Date 9/27/05

Time Begin 15:00 End Time: 16:20

Creek: Indian Creek

Station: 3

Reach Length: 48 m

GPS UTM, 10, NA 4445798 N 702344 E

Weather: Mostly clear; mid 70's by afternoon

Pass		Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1		Brown Trout	83	1	5	
		Brown Trout	73	1	4	
		Brown Trout	77	1	5	
				<b>3</b>	<b>14</b>	
2		Brown Trout	181	1	62	
		Brown Trout	146	1	34	
		Brown Trout	73	1	3.5	
				<b>3</b>	<b>99.5</b>	
3		Brown Trout	227	1	130	
		Brown Trout	163	1	46	
				<b>2</b>	<b>176</b>	
4				0		
				<b>0</b>		

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer  
 Date 9/28/05 Time Begin 09:00 End Time: 09:40  
 Creek: Indian Creek Station: 4  
 Reach Length: 81 m GPS UTM, 10, NA 4444619 N 702259 E  
 Weather: Mostly clear; mid 70's by afternoon

Pass		Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1		Brown Trout	82	1	7	
		Brown Trout	84	1	6	
		Brown Trout	86	1	8	
		Brown Trout	89	1	8	
		Brown Trout	90	1	8	
		Brown Trout	94	1	9.5	
		Brown Trout	95	1	9	
		Brown Trout	145	1	33	
		Brown Trout	149	1	43	
		Brown Trout	154	1	43	
		Brown Trout	160	1	48	
		Brown Trout	161	1	44	
		Brown Trout	163	1	45	
		Brown Trout	164	1	52	
		Brown Trout	165	1	51	
		Brown Trout	166	1	56	
		Brown Trout	175	1	58	
		Brown Trout	177	1	62	
		Brown Trout	177	1	32	
		Brown Trout	181	1	71	
		Brown Trout	183	1	70	
		Brown Trout	187	1	76	
		Brown Trout	198	1	89	
		Brown Trout	218	1	117	
		Brown Trout	219	1	124	
		Brown Trout	234	1	145	
		Brown Trout	249	1	123	
		Brown Trout	257	1	175	
		Brown Trout	322	1	380	
		Brown Trout	370	1	600	
				<b>30</b>	<b>2592.5</b>	
		Rainbow Trout	159	1	42	
		Rainbow Trout	104	1	11.5	
				<b>2</b>	<b>53.5</b>	
2		Brown Trout	98	1	11	
		Brown Trout	102	1	12	
		Brown Trout	168	1	59	
		Brown Trout	169	1	52	
		Brown Trout	179	1	70	
		Brown Trout	180	1	59	
		Brown Trout	200	1	95	
		Brown Trout	285	1	240	
				<b>8</b>	<b>598</b>	

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer  
 Date 9/28/05 Time Begin 1515 End Time: 1630  
 Creek: Indian Creek Station: 5  
 Reach Length: 60 m GPS UTM, 10, NA 4441281 N 700801 E  
 Weather: Mostly clear; mid 70's by afternoon

Pass		Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1		Brown Trout	71	1	4	
		Brown Trout	72	1	4.5	
		Brown Trout	73	1	4.5	
		Brown Trout	76	1	6	
		Brown Trout	85	1	7	
		Brown Trout	85	1	7	
		Brown Trout	88	1	7.5	
		Brown Trout	88	1	7.5	
		Brown Trout	89	1	7	
		Brown Trout	90	1	10	
		Brown Trout	91	1	8.5	
		Brown Trout	98	1	11.5	
		Brown Trout	148	1	29	
		Brown Trout	151	1	43	
		Brown Trout	155	1	40	
		Brown Trout	155	1	38	
		Brown Trout	156	1	43	
		Brown Trout	158	1	46	
		Brown Trout	167	1	61	
		Brown Trout	170	1	53	
		Brown Trout	182	1	70	
		Brown Trout	185	1	75	
		Brown Trout	190	1	90	
		Brown Trout	240	1	160	
		Brown Trout	256	1	188	
				<b>25</b>	<b>1021</b>	
		Rainbow Trout	50	1	1.5	
		Rainbow Trout	66	1	4	
		Rainbow Trout	125	1	22	
		Rainbow Trout	130	1	16	
		Rainbow Trout	240	1	150	
				<b>5</b>	<b>193.5</b>	
2		Brown Trout	71	1	4	
		Brown Trout	72	1	4	
		Brown Trout	76	1	5	
		Brown Trout	86	1	7.5	
		Brown Trout	157	1	47	
		Brown Trout	174	1	61	
		Brown Trout	190	1	66	
		Brown Trout	255	1	183	
				<b>8</b>	<b>377.5</b>	
		Rainbow Trout	61	1	2	
		Rainbow Trout	64	1	3	
		Rainbow Trout	69	1	3	
		Rainbow Trout	139	1	30	
				<b>4</b>	<b>38</b>	

Crew: David Grant, Ralph Hinton, Aric Lester, Audrey Silbernagel, Mara Kraemer  
 Date 9/29/05 Time Begin 0900 End Time: 0940  
 Creek: Indian Creek Station: 6  
 Reach Length: 59.5 m GPS UTM, 10, NA 4437837 N 698249 E  
 Weather: Mostly clear; mid 70's by afternoon

Pass		Common Name	FL (mm)	Total #	Total Displacement (ml)	Note
1		Rainbow Trout	135	1	27	
		Rainbow Trout	137	1	30	
		Rainbow Trout	137	1	25	
		Rainbow Trout	144	1	34	
		Rainbow Trout	145	1	32	
		Rainbow Trout	150	1	37	
		Rainbow Trout	160	1	44	
		Rainbow Trout	179	1	60	
		Rainbow Trout	179	1	59	
		Rainbow Trout	200	1	72	
				<b>10</b>	<b>420</b>	
		Brown Trout	94	1	8.5	
		Brown Trout	96	1	9	
		Brown Trout	99	1	10.5	
		Brown Trout	100	1	10.5	
		Brown Trout	100	1	10.5	
		Brown Trout	116	1	6.5	
		Brown Trout	132	1	24	
				<b>7</b>	<b>79.5</b>	
		Sacramento Sucke	98	1	12.5	
		Sacramento Sucke	125	1	24	
		Sacramento Sucke	138	1	31	
		Sacramento Sucke	144	1	33	
		Sacramento Sucke	150	1	39	
				<b>5</b>	<b>139.5</b>	
		Sacramento Pikem	72	1	4	
		Sacramento Pikem	74	1	4	
		Sacramento Pikem	115	1	15	
		Sacramento Pikem	120	1	20	
				<b>4</b>		
		Green Sunfish	75	1	9.5	
				<b>1</b>		
2		Rainbow Trout	186	1	85	
				<b>1</b>	<b>85</b>	
		Brown Trout	94	1	10	
		Brown Trout	104	1	10.5	
		Brown Trout	105	1	14	
		Brown Trout	164	1	44	
				<b>4</b>	<b>78.5</b>	
		Sacramento Sucke	53	1	2	
		Sacramento Sucke	92	1	10.5	
				<b>2</b>	<b>12.5</b>	
		Sacramento Pikem	105	1	11	
				<b>1</b>	<b>11</b>	

## 2005 Electrofisher Settings and Effort

Station	Efisher Model	Volts	Duty Cycle	Frequency	Effort (seconds)		
					Pass 1	Pass 2	Pass 3
1	LR24	500	50%	60Hz	1004	941	-
2	LR24/12B <sup>1</sup>	500	50%	50Hz	771	No Timer <sup>2</sup>	-
3	LR24	395	35%	30Hz	574	606	514
4	LR24	500	50%	50Hz	1353	1134	-
5	12B	500	50%	50Hz	No Timer	No Timer	-
6	LR24	500	50% - 30% <sup>3</sup>	50Hz	1033	753	-

<sup>1</sup> Used Smithroot 12B on second pass for station 2; exhausted batteries for LR24

<sup>2</sup> The 12B electrofisher did not have a timer

<sup>3</sup> Reduced duty cycle to conserve low battery

## 2005 Water Quality Measurements

Station	Conductivity $\mu$ S	TDS mg/L	Salinity ppm	Water Temp
1	80.6	63	62.8	
2	88.3	63.7	62.7	
3	84.8	58.3	57.6	
4	84.5	60.7	59.7	
5	86.2	59.9	62.0	
6	91.6	61.8	62.5	10°C

## Station Photos

Station 1

Upstream Net Site



Downstream Net Site



## Station 2

From downstream end looking upstream



From upstream end looking downstream



## Station 3

Downstream view of upstream net at  
head of riffle



Downstream net site



#### Station 4

Looking upstream to upstream end of station.  
Blocked by beaver dam (not shown)



Downstream net site



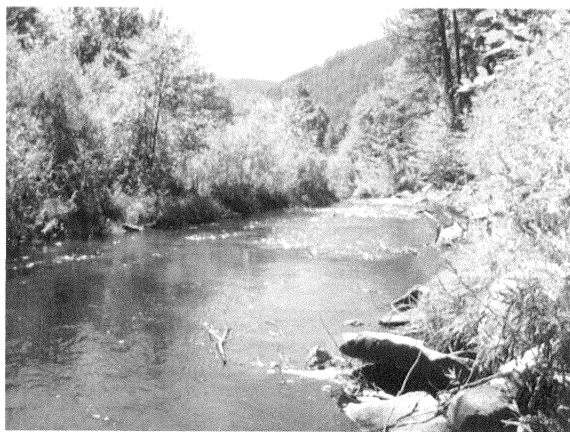
#### Station 5

Looking upstream from approximate location  
of downstream net site.



#### Station 6

Looking downstream to downstream net site  
from location just downstream of upstream net  
site.



## CONVERSION FACTORS

Quantity	To convert from customary unit	To metric unit	Multiply customary unit by	To convert to customary unit, multiply metric unit by
Length	inches (in)	millimeters (mm)*	25.4	0.03937
	inches (in)	centimeters (cm)	2.54	0.3937
	feet (ft)	meters (m)	0.3048	3.2808
	miles (mi)	kilometers (km)	1.6093	0.62139
Area	square inches (in <sup>2</sup> )	square millimeters (mm <sup>2</sup> )	645.16	0.00155
	square feet (ft <sup>2</sup> )	square meters (m <sup>2</sup> )	0.092903	10.764
	acres (ac)	hectares (ha)	0.40469	2.4710
	square miles (mi <sup>2</sup> )	square kilometers (km <sup>2</sup> )	2.590	0.3861
Volume	gallons (gal)	liters (L)	3.7854	0.26417
	million gallons (10 <sup>6</sup> gal)	megaliters (ML)	3.7854	0.26417
	cubic feet (ft <sup>3</sup> )	cubic meters (m <sup>3</sup> )	0.028317	35.315
	cubic yards (yd <sup>3</sup> )	cubic meters (m <sup>3</sup> )	0.76455	1.308
	acre-feet (ac-ft)	thousand cubic meters (m <sup>3</sup> x 10 <sup>3</sup> )	1.2335	0.8107
	acre-feet (ac-ft)	hectare-meters (ha - m)■	0.1234	8.107
	thousand acre-feet (taf)	million cubic meters (m <sup>3</sup> x 10 <sup>6</sup> )	1.2335	0.8107
	thousand acre-feet (taf)	hectare-meters (ha - m)■	123.35	0.008107
	million acre-feet (maf)	billion cubic meters (m <sup>3</sup> x 10 <sup>9</sup> )♦	1.2335	0.8107
	million acre-feet (maf)	cubic kilometers (km <sup>3</sup> )	1.2335	0.8107
Flow	cubic feet per second (ft <sup>3</sup> /s)	cubic meters per second (m <sup>3</sup> /s)	0.028317	35.315
	gallons per minute (gal/min)	liters per minute (L/min)	3.7854	0.26417
	gallons per day (gal/day)	liters per day (L/day)	3.7854	0.26417
	million gallons per day (mgd)	megaliters per day (ML/day)	3.7854	0.26417
	acre-feet per day (ac-ft/day)	thousand cubic meters (m <sup>3</sup> x 10 <sup>3</sup> /day)	1.2335	0.8107
Mass	pounds (lb)	kilograms (kg)	0.45359	2.2046
	tons (short, 2,000 lb)	megagrams (Mg)	0.90718	1.1023
Velocity	feet per second (ft/s)	meters per second (m/s)	0.3048	3.2808
Power	horsepower (hp)	kilowatts (kW)	0.746	1.3405
Pressure	pounds per square inch (psi)	kilopascals (kPa)	6.8948	0.14505
	feet head of water	kilopascals (kPa)	2.989	0.33456
Specific capacity	gallons per minute per foot of drawdown	liters per minute per meter of draw-down	12.419	0.08052
Concentration	parts per million (ppm)	milligrams per liter (mg/L)	1.0	1.0
Electrical conductivity	micromhos per centimeter	microsiemens per centimeter (μS/cm)	1.0	1.0
Temperature	degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32)/1.8	(1.8 x °C) + 32

\* When using "dual units," inches are normally converted to millimeters (rather than centimeters).

■ Not used often in metric countries, but is offered as a conceptual equivalent of customary western U.S. practice (a standard depth of water over a given area of land).

♦ ASTM Manual E380 discourages the use of billion cubic meters since that magnitude is represented by *giga* (a thousand million) in other countries. It is shown here for potential use for quantifying large reservoir volumes (similar to million acre-feet).